

Recorder with Musical Glasses *Obligato*

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Sometime after age forty, everyone experiences a phenomenon I call the "optical trombone effect" (or "optical sackbut effect" for the early music crowd). Like a trombonist reaching for sixth position, folks have to push things farther and farther away to see them clearly. And it's worse with fine print or in dim light.

What it's called is *presbyopia*, an impressive and impolite Latin word meaning "old sight" or, in politically correct terms, proximally challenged. The remedy is simple--reading glasses or bifocals. But the glasses that work fine for sitting in the rocker and reading *Early Music America* or *The American Recorder* may not be so good for playing music. Fortunately there are a variety of solutions for musicians nowadays.

But before we go into that, let's take a minute to get a better idea of what's going on here.

Presbyopia

In an eye examination, the optometrist's first concern is finding the lens that lets the patient see details of things that are far away. That's why he has you reading gibberish like **APEOTF**, **TZEVCL**, and **OHPNTZ** on the eye chart at the end of the room while he changes lenses and intones "which is better, one or two?" Believe it or not, the lenses that let you see that chart clearly will also let you see a street sign, the Good Year blimp, or the moon. And if you're young enough, you can probably read with them, too.

But reading with distance glasses requires the eye to make an internal adjustment called *accommodation*. To see how that works we need to know a little—just a little—anatomy. Figure 1 shows schematically the optical components of the human eye. The rest of the eye exists solely to conduct light to the *retina*, a structure at the back of the eye equipped with light receptors and neural networks to send information on to the brain. Light rays from an object are bent to form a retinal image

by the *cornea*, the hard transparent tissue at the front of the eye, and the *crystalline lens*, a transparent structure inside the eye. (A *cataract* is formed when the crystalline lens turn cloudy, as it often does with age. The appearance of the white lens of an advanced cataract reminded somebody of rushing water, hence the name.) Just in front of the crystalline lens is the *iris*, the structure that determines whether eyes are brown, blue, or hazel. Most of the rest of the eye is filled with fluid, the *aqueous humor* in front of the iris and the jelly-like *vitreous humor* behind the iris.

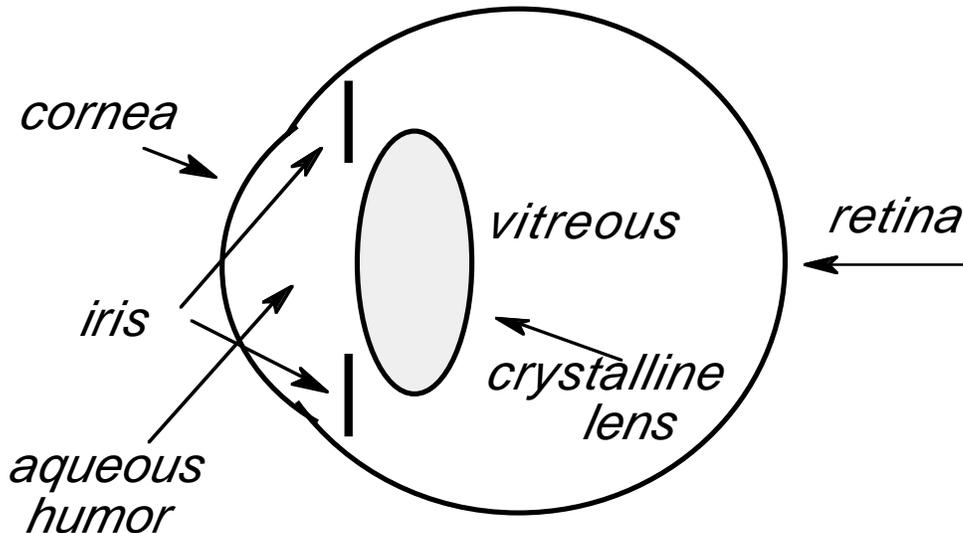


Figure 1. Basic ocular anatomy

Now suppose an individual who sees things far away just fine wants to look at something close up. As shown in figure 2a, the eye, being focused for distance, will form the image of the near object behind the retina, so the retina only receives a blurred image. The eye focuses this image by constricting a sphincter muscle called the *ciliary body* just behind the iris. That permits the crystalline lens to bulge. The extra curvature of the lens brings the image to crisp focus on the retina, as shown in figure 2b. That whole process is called *accommodation*.

With age, the crystalline lens becomes harder and harder and loses its ability to change shape. The hardening process progresses through most of life, but only becomes critical around age 40. By the early 50's, the crystalline lens has become completely rigid and accommodation is no longer possible. It's all part of nature's plan to remind us that in primitive times, i.e. before college tuition rose so high, folks over 40 were pretty much expendable.

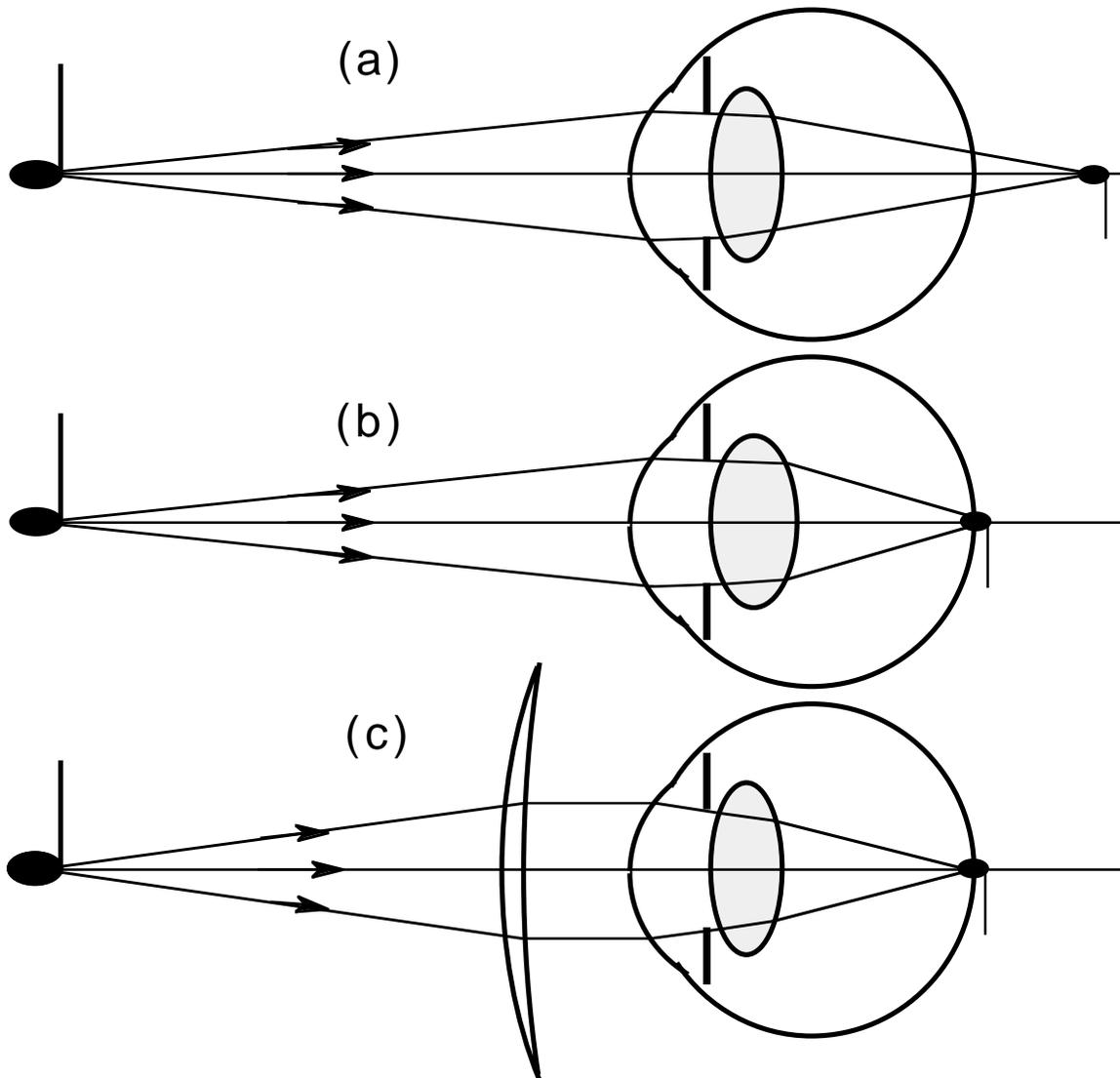


Figure 2

- a) Images of near objects are formed behind the eye, with corresponding retinal blur
- b) Young eyes can focus the image of a near object by accommodating, which causes the crystalline lens to bulge
- c) In older eyes, the accommodation can be done by a spectacle lens

Optometrists compensate for the diminished focusing capacity of the crystalline lens by placing a converging lens in front of the eye, as shown in figure 2c. That lens may be given as simple single vision reading glasses, as bifocals which incorporate both the near and distance spectacle prescriptions, or as multifocals which incorporate near,

distance, and intermediate distance prescriptions. The style and optical power of the spectacles prescribed depends on the needs of the patient. Most presbyopes need a distance prescription for driving, concerts, and the like; and they need lenses to read reading matter held about 40 centimeters (16 inches) from the eye. And usually they want to be able to change from distance to near tasks without changing glasses.

The most common solution is a bifocal of some sort (figure 3). But that might not work out so well for a musician for a couple of reasons. First, a bifocal is usually prescribed for the 40 centimeter (16 inch) reading distance, but the working distance for a musician is arm's length, about 65 centimeters (25 inches). Optically, there is more difference between reading distance and arm's length than between a billboard and alpha centauri, so a musician, especially one over 45, may find that music is clear through neither the top nor the bottom of his bifocal. Second, bifocals are prescribed on the assumption that reading material can be held a bit below the usual line of sight. But music stands and harpsichord racks are usually placed straight ahead. As result, a bifocal user may get a stiff neck from tilting his head back to see his music.

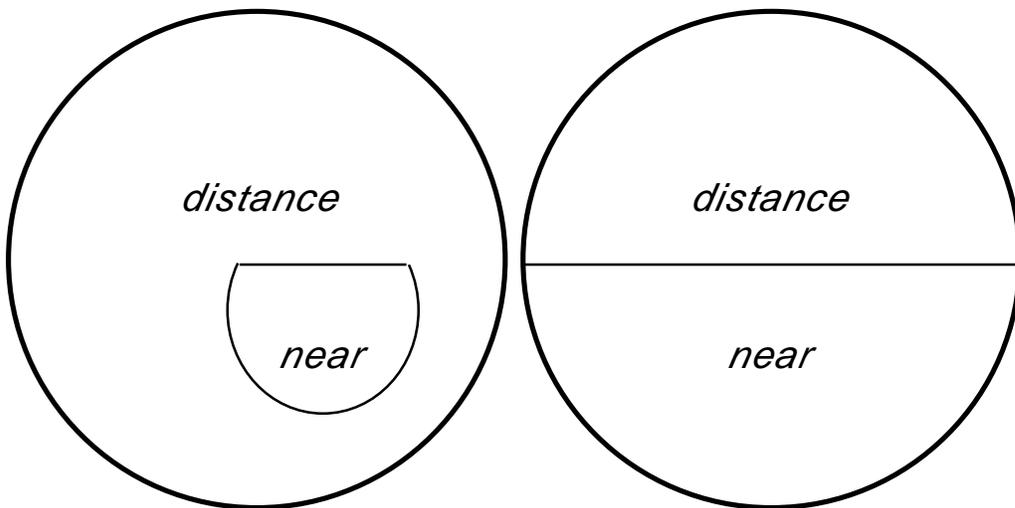


Figure 3. Two kinds of bifocals, the straight top (left) and Executive (right).

Solutions

The easiest solution to the musical glasses problem is single vision music glasses. These are reading glasses with the optical power chosen for a 65 centimeter (25 inch) working distance, arm's length. Your

optometrist can order these by simply adding +1.50 diopters power to your distance prescription. (Don't worry, he'll know how to do this). You won't be able to see distant objects clearly with these glasses, and if you're over 50 it may be tough to read fine print with them. But you'll see your music fine and the keyboard as well, if you're a harpsichordist, even though you won't see the conductor or the audience too well. Clearly these are special purpose vocational (or avocational) glasses and you'll still need a bifocal for most non-musical activities. But the single vision lenses are relatively inexpensive. A few happy myopes with prescriptions of about 1.50 diopters power can even get the same optical effect as music glasses by simply removing their spectacles and playing with no glasses at all.

Conventional bifocals (figure 3) may work fine for recorder playing if you're in your early 40's and still have a low powered reading correction. You'll have to keep your music stand low, though, so you're not twisting your neck to look through the segment. If you are in your 50's or late 40's, chances are your bifocal is too strong to see music at arm's length. Try using a pair of your old glasses. If you get on well with them, ask your optometrist to make up a special pair of glasses with a +1.50 diopter add in the bifocal. You won't be able to read fine print with them, but if you don't get a stiff neck you can play music and see the conductor with the same glasses.

Some doctors like to prescribe trifocals (figure 4) for presbyopic patients who want one pair of glasses to do everything. The trifocal has a narrow strip of optics designed for intermediate distances, below which is the usual bifocal. There are a couple of problems with this approach. First, the intermediate band of conventional trifocals is quite narrow, so the head has to be held just right. This can be especially difficult if, as is often the case, the optical dispenser sets the trifocal too low. Second, the optical power of most intermediates actually corresponds to a working distance of about one meter (one yard), about 35 centimeters (14 inches) *beyond* arm's length. That's too far away for a musician. Avoid trifocals for playing music.

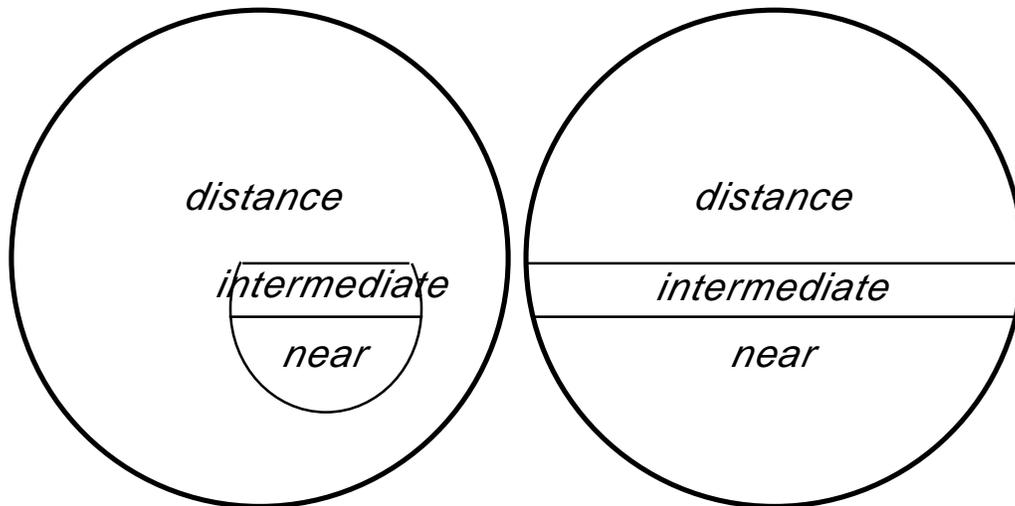


Figure 3. Two kinds of trifocals, the straight top (left) and Executive (right).

For most presbyopic patients who need an intermediate viewing distance in ordinary activities, I recommend a progressive addition lens (PAL) (figure 5). These are sometimes called "no line bifocals". The best known brand name is Varilux, but there are around thirty other manufacturers in the market nowadays. They all work pretty well if they are carefully dispensed.

Progressive addition lenses are marketed chiefly for their appearance ("Who needs more lines," coyly asked one Varilux ad), but they are optically useful because they provide an intermediate viewing distance. In fact they provide a continuously varying intermediate distance along a corridor connecting the distance part of the lens to the near part (figure 5), hence the name "progressive add". The price of this optical magic is a relatively small reading area on the lens compared to conventional bifocals, and a couple of optically unusable lens areas crammed at the bottom and outside of the lenses. Progressive addition lenses are expensive and may take a bit of getting used to, but are the ideal solution for most presbyopes. I wear them--but not to make music. The problem is that the intermediate is just too narrow. To read music on a music stand or rack, the head must be held just so, which gets pretty tiring.

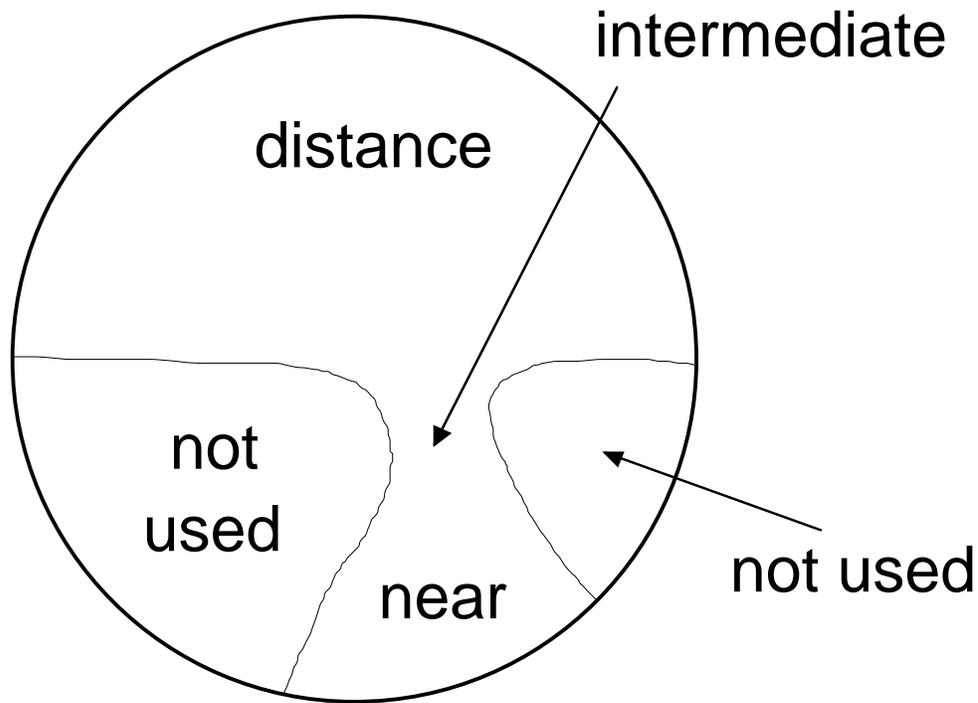


Figure 5. The layout of a progressive addition lens. The grey lines in the diagram above indicate the different regions of the lens, but are not actually visible on the lens.

As it happens, the optical problem of the presbyopic musician is essentially identical to that of the microcomputer user. Both have to see something at about arm's length. The increasing ubiquity of the microcomputer in the last half dozen years has led to development of lenses especially designed for the presbyope who uses visual display terminals. A couple of designs currently available are the Gradal RD manufactured by Zeiss and the Access made by Sola. Technically these are progressive addition lenses—but with a difference. These computer lenses have a large intermediate portion covering most of the center of the lens, with a small reading portion at the bottom and a small distance portion at the top. That means that with these glasses a musician can read music without getting a stiff neck, see the conductor and audience fairly clearly when looking up, and even read those little footnotes with the fingering for high C. Like single vision music glasses, these are special purpose glasses. In particular, you can't drive with them. Some adaptation is required, but less than with most other bifocals or trifocals. In my opinion, these computer lenses are the best solution available for

the musician. Mine live in my case with my recorders so I won't forget them on the way to a music session.

One final hint: if you get special purpose music glasses, make sure they're in a frame significantly different from your regular glasses. I once squinted through my music glasses during an entire hockey game because I grabbed the wrong pair.

Conclusion

The final choice of music glasses is an individual thing that you should work out with your optometrist. Choose a doctor that's willing to spend a bit of time with you and make sure he understands your problem. You might even want to take an instrument and some music to your appointment. Once you have a good pair of music spectacles you can ban that optical trombonist from your broken consort forever!

Biographical Information on the author:

William Long teaches optics and clinical optometry at the University of Missouri-St. Louis College of Optometry. He plays recorders and keyboards, and is organist/choir director for Trinity Episcopal Church in St. Charles, Missouri.